

§ 108.437 Pipe sizes and discharge rates for enclosed ventilation systems for rotating electrical equipment.

(a) The minimum pipe size for the initial charge must meet table 108.441 and the discharge of the required amount of CO₂ must be completed within 2 minutes.

(b) The minimum pipe size for the delayed discharge must be at least 1.25 centimeters (½ inch) standard pipe.

(c) The pipe used for the initial discharge must not be used for the delayed discharge, except systems having a volume of less than 57 cubic meters (2,000 cubic feet).

§ 108.439 Quantity of CO₂ for protection of spaces.

(a) The number of pounds of CO₂ required to protect a space must be equal to the gross volume of the space divided by the appropriate factor from Table 108.439.

(b) If a machinery space includes a casing, the gross volume of the space may be calculated using the reductions allowed in 46 CFR 95.10–5(e).

(c) If fuel can drain from a space to an adjacent space or if two spaces are not entirely separate, the requirements for both spaces must be used to determine the amount of CO₂ to be provided and the CO₂ system must be arranged to discharge into both spaces simultaneously.

TABLE 108.439—CO₂ Supply Factors

[Gross volume of space in cubic feet]

Over	Not over	Factor
0	500	15
500	1,600	16
1,600	4,500	18
4,500	50,000	20
50,000		22

§ 108.441 Piping and discharge rates for CO₂ systems.

(a) The size of branch lines to spaces protected by a CO₂ system must meet Table 108.441.

(b) Distribution piping within a space must be proportioned from the supply line to give proper distribution to the outlets without throttling.

(c) The number, type, and location of discharge outlets must distribute the CO₂ uniformly throughout the space.

TABLE 108.441—CO₂ System Pipe Size

CO ₂ supply in system, kilograms (pounds)	Minimum pipe size (inches), millimeters (inches)
45 (100)	12.7 (½).
104 (225)	19.05 (¾).
136 (300)	25.4 (1).
272 (600)	31.75 (1¼).
450 (1,000)	38.10 (1½).
1,110 (2,450)	50.80 (2).
1,130 (2,500)	63.5 (2½).
2,023 (4,450)	76.2 (3).
3,229 (7,100)	88.9 (3½).
4,750 (10,000)	101.6 (4).
6,818 (15,000)	114.3 (4½).

(d) The total area of all discharge outlets must be more than 35 percent and less than 85 percent of the nominal cylinder outlet area or the area of the supply pipe, whichever is smaller. The nominal cylinder outlet area in square centimeters is determined by multiplying the factor 0.0313 by the number of kilograms of CO₂ required. (The nominal cylinder outlet area in square inches is determined by multiplying the factor 0.0022 by the number of pounds of CO₂ required). The nominal cylinder outlet area must not be less than 71 square millimeters (0.110 square inches).

(e) A CO₂ system must discharge at least 85 percent of the required amount within 2 minutes.

§ 108.443 Controls and valves.

(a) At least one control for operating a CO₂ system must be outside the space or spaces that the system protects and in a location that would be accessible if a fire occurred in any space that the system protects. Control valves must not be located in a protected space unless the CO₂ cylinders are also in the protected space.

(b) A CO₂ system that protects more than one space must have a manifold with a stop valve, the normal position of which is closed, that directs the flow of CO₂ to each protected space.

(c) A CO₂ system that protects only one space must have a stop valve installed between the cylinders and the discharge outlets in the system, except on a system that has a CO₂ supply of 136 kilograms (300 pounds) or less.

(d) At least one of the control stations in a CO₂ system that protects a machinery space must be as near as

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practicable to one of the main escapes from that space.

(e) All distribution valves and controls must be of an approved type.

(f) Each CO₂ system that has a stop valve must have a remote control that operates only the stop valve and must have a separate remote control for releasing the required amount of CO₂ into the space protected by the system.

(g) Each CO₂ system that does not have a stop valve must be operated by a remote control that releases the required amount of CO₂ into the space protected by the system.

(h) Remote controls to each space must be in an enclosure.

(i) Each system must have a manual control at its cylinders for releasing CO₂ from the cylinders, except that if the system has pilot cylinders, a manual control is not required for other than pilot cylinders.

(j) If gas pressure is used to release CO₂ from a system having more than 2 cylinders, the system must have at least 2 pilot cylinders to release the CO₂ from the remaining cylinders.

(k) If the entrance to a space containing the CO₂ supply or controls of a CO₂ system has a lock, the space must have a key to the lock in a break-glass type box that is next to and visible from the entrance.

§ 108.445 Alarm and means of escape.

(a) Each CO₂ system that has a supply of more than 136 kilograms (300 pounds) of CO₂, except a system that protects a tank, must have an alarm that sounds for at least 20 seconds before the CO₂ is released into the space.

(b) Each audible alarm for a CO₂ system must have the CO₂ supply for the system as its source of power and must be in a visible location in the spaces protected.

§ 108.447 Piping.

(a) Each pipe, valve, and fitting in a CO₂ system must have a bursting pressure of at least 420 kilograms per square centimeter (6,000 pounds per square inch).

(b) All piping for a CO₂ system of nominal size of 19.05 millimeters ($\frac{3}{4}$ inch) inside diameter or less must be at least Schedule 40 (standard weight) and all piping of nominal size over 19.05

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millimeters ($\frac{3}{4}$ inch) inside diameter must be at least Schedule 80 (extra heavy).

(c) Each pipe, valve, and fitting made of ferrous materials in a CO₂ system must be protected inside and outside from corrosion.

(d) Each CO₂ system must have a pressure relief valve set to relieve between 168 and 196 kilograms per square centimeter (2,400 and 2,800 pounds per square inch) in the distribution manifold or other location that protects the piping when all branch line shut off valves are closed.

(e) The end of each branch line in a CO₂ system must extend at least 50 millimeters (2 inches) beyond the last discharge outlet and be closed with a cap or plug.

(f) Piping, valves, and fittings in a CO₂ system must be securely supported and protected from damage.

(g) Each CO₂ system must have drains and dirt traps located where dirt or moisture can accumulate in the system.

(h) Discharge piping in a CO₂ system may not be used for any other purpose except as part of a fire detection system.

(i) Piping in a CO₂ system that passes through accommodation spaces must not have drains or other openings within these spaces.

§ 108.449 Piping tests.

(a) Each test prescribed in (b), (c), and (d) of this section must be performed upon completion of the piping installation.

(b) When tested with CO₂ or other inert gas under a pressure of 70 kilograms per square centimeter (1000 pounds per square inch), with no additional gas introduced into the system, the leakage in the piping from the cylinders to the stop valves in the manifold must not allow a pressure drop of more than 10.5 kilograms per square centimeter (150 pounds per square inch) per minute for a 2 minute period.

(c) When tested with CO₂ or other inert gas under a pressure of 42 kilograms per square centimeter (600 pounds per square inch), with no additional gas introduced into the system, the leakage in each branch line must not allow a pressure drop of more than